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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MICHEL BETANCOURT and DIPAK M. PATEL

Appeal 2008-001478
Application 10/675,181¹
Technology Center 2100

Decided: September 2, 2009

Before JOSEPH L. DIXON, JEAN R. HOMERE, and STEPHEN C. SIU,
Administrative Patent Judges.

HOMERE, *Administrative Patent Judge.*

DECISION ON APPEAL

¹ Filed on September 30, 2003. The real party in interest is International Business Machines Corp.

I. STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's final rejection of claims 1 through 4, 6 through 10, and 12 through 16. Claims 5 and 11 have been cancelled. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm-in-part.

Brief Summary of the Invention

Appellants invented a method, system, and machine readable storage for detecting and remediating an autonomic memory leak via garbage collection. (Spec. 1, ll. 2-3; Spec. 7, ll. 1-2.) Appellants' Figure 3A depicts creating a new object instance in memory (310). (Spec. 8, ll. 18-20.) Further, Appellants' Figure 3B depicts that when an object instance disposed in memory is referenced by an active process, the aging value associated with an object instance (345) is reset before the process ends (350). (Spec. 9, ll. 3-6.) During the core garbage collection process, the aging value of each object instance in memory is queried to identify those object instances which have not been referenced by an active process during previous cycles of the garbage collection process. (Spec. 9, ll. 6-9.) The objects instances identified are considered loiterers and processed accordingly. (Spec. 9, ll. 9-10.)

Illustrative Claim

Independent claim 6 further illustrates the invention as follows:

6. A method for detecting and remediating a memory leak, the method comprising the steps of:

establishing an aging value for an object instance created in memory;

resetting said aging value when said object instance is referenced by an executing process;

incrementing said aging value during a garbage collection pass when said object instance had not been referenced by an executing process since a previous garbage collection pass; and,

when said aging value exceeds a threshold value, processing said object instance as a loiterer.

Prior Art Relied Upon

The Examiner relies on the following prior art as evidence of unpatentability:

Menon	US 5,933,840	Aug. 3, 1999
Ozawa	US 2001/0023478 A1	Sept. 20, 2001
Chakraborty	US 2002/0165870 A1	Nov. 7, 2002

Rejections on Appeal

The Examiner rejects the claims on appeal as follows:

Claims 6, 8, 13, and 15 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Menon.

Claims 1 through 4, 9, 10, 12, and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Menon and Ozawa.

Claims 7 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Menon and Chakraborty.

Appellants' Contentions

1. Appellants contend that the Examiner erred in finding that Menon anticipates independent claims 6 and 13. In particular, Appellants argue that:

(a) Menon's disclosure of age-queue buckets and associated utilization values does not teach resetting an aging value when an object

instance is referenced by an executing process. (App. Br. 4-5, Reply Br. 1-4.)

(b) Menon's disclosure of a process wherein the age of a segment is defined as the difference between the current value of the destage clock and the timestamp of the segment itself does not teach incrementing an aging value during a garbage collection pass when the object instance had not be referenced by an executing process since a previous garbage collection pass. (App. Br. 5-6; Reply Br. 4-5.)

2. Appellants contend that the Examiner erred in concluding that the combination of Menon and Ozawa renders independent claim 1 unpatentable. In particular, Appellants argue that Ozawa's disclosure of color fields only indicates the status of a cell and does not teach a list of exempt classes based upon which object instances are exempted from being labeled loiterers. (App. Br. 7-9; Reply Br. 7-8.)

Examiner's Findings and Conclusion

1. The Examiner finds that Menon anticipates independent claims 6 and 13. In particular, the Examiner finds that:

(a) Menon's disclosure of garbage collection in a log-structured storage system, in conjunction with age-queue buckets that cover a range of utilization values, teaches resetting the aging value when an object instance is referenced by an executing process. (Ans. 19-22.)

(b) Menon's disclosure of an age segment defined as the difference between the current value of the destage clock and the timestamp of the segment itself, in conjunction with segments used by write operations waiting an age threshold amount before they become candidates for garbage collection, teaches incrementing the aging value during a garbage collection

pass when the object instance had not been referenced by an executing process since a previous garbage collection pass. (Ans. 22-23.)

2. The Examiner concludes that the combination of Menon and Ozawa renders independent claim 1 unpatentable. In particular, the Examiner finds that Ozawa's disclosure of color field displays attached to cells whereby white-marked cells indicate garbage and black-marked cells indicate non-garbage teaches a listing of exempt classes based upon which object instances are exempted from being labeled loiterers. (Ans. 24-27.)

II. ISSUES

1. Have Appellants shown that the Examiner erred in finding that Menon anticipates independent claims 6 and 13? In particular, the issue turns on whether Menon teaches resetting the aging value when the object instance is referenced by an executing process, as recited in independent claims 6 and 13.

2. Have Appellants shown that the Examiner erred in concluding that the combination of Menon and Ozawa renders independent claim 1 unpatentable? In particular, the issue turns on whether Ozawa teaches a listing of exempt classes based upon which object instances are exempted from being labeled loiterers, as recited in independent claim 1.

III. FINDINGS OF FACT

The following Findings of Fact ("FF") are shown by a preponderance of the evidence.

Menon

1. Menon discloses an information storage system that selects target segments for garbage collection only if their age in the information storage system exceeds an age threshold value and, once past the age threshold, in the order of least utilized segments first. (Abstract; Col. 5, ll. 19-24.)

2. Menon's Figure 1 depicts that the age of a segment is determined with a time processor destage clock (132) that generates a timestamp value for a segment when that segment is filled in the memory segment buffer (128) and is written into the direct access storage device ("DASD") array (106). (Col. 10, ll. 11-15.) In particular, the time processor destage clock is initially set to zero. (Col. 10, ll. 15-16.) When a segment is filled by track writing operations from the processor (102) ("a TW-filled segment"), the timestamp associated with that segment is set to the current value of the destage clock, and the destage clock is then incremented by one. (Col. 10, ll. 16-20.) When a segment is filled by live tracks taken from garbage-collect segments ("a GC-filled segment"), the timestamp associated with the segment is set to the largest timestamp of any segment that contributed a track to it during the garbage collection. (Col. 10, ll. 21-25.) The age of a segment is defined as the difference between the current value of the destage clock and the timestamp of the segment itself. (Col. 10, ll. 28-30.) Therefore, the GC-filled segment initially has an age equal to the age of the youngest segment that contributed tracks to it. (Col. 10, ll. 30-32.) For example, if the destage clock value is currently set to ten, and if the threshold value is set to four, then a segment must have a timestamp value of

at most (10-4) or six to be old enough for garbage collection consideration.
(Col. 10, ll. 32-36.)

Ozawa

3. Ozawa generally relates to a technology for managing memory resources. In particular, it relates to a technology for managing memory resources used by the execution of an application program and executing a garbage collection process for collecting free memory areas of the memory resources. (Para. [0002].)

4. Ozawa discloses that in the description of garbage collection (“GC”), a memory resource to be managed is called a “heap.” (Para. [0005].) The heap is composed of units of data strings called cells (or objects). (Para. [0005].) According to partial marking garbage collection (“PMGC”), cells are marked in three colors: white, black, and off-white. (Para. [0153].) In this case, white-marked cells can be judged to be “garbage” and black-marked cells cannot be judged to be “garbage.” (Para. [0153].)

IV. PRINCIPLES OF LAW

Anticipation

In rejecting claims under 35 U.S.C. § 102, “[a] single prior art reference that discloses, either expressly or inherently, each limitation of a claim invalidates that claim by anticipation.” *Perricone v. Medicis Pharm. Corp.*, 432 F.3d 1368, 1375 (Fed. Cir. 2005) (citing *Minn. Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1565 (Fed. Cir. 1992)).

Anticipation of a patent claim requires a finding that the claim at issue ‘reads on’ a prior art reference. In other words, if

granting patent protection on the disputed claim would allow the patentee to exclude the public from practicing the prior art, then that claim is anticipated, regardless of whether it also covers subject matter not in the prior art.
Atlas Powder Co. v. IRECO, Inc., 190 F.3d 1342, 1346 (Fed Cir. 1999)
(internal citations omitted).

Obviousness

“On appeal to the Board, an applicant can overcome a rejection [under § 103] by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.” *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998).

Section 103 forbids issuance of a patent when “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.”

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007).

In *KSR*, the Supreme Court emphasized “the need for caution in granting a patent based on the combination of elements found in the prior art,” and discussed circumstances in which a patent might be determined to be obvious. *Id.* at 415 (citing *Graham v. John Deere Co.*, 383 U.S. 1, 13-14 (1966)). The Court reaffirmed principles based on its precedent that “[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *Id.* at 416.

The Court explained:

When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable

variation, §103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

Id. at 417.

The operative question in this "functional approach" is thus "whether the improvement is more than the predictable use of prior art elements according to their established functions." *Id.* at 415, 417.

In identifying a reason that would have prompted a person of ordinary skill in the relevant field to combine the prior art teachings, the Examiner must show some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

V. ANALYSIS

35 U.S.C. § 102(b)

Claims 6 and 13

Independent claims 6 and 13 recite, in relevant part, resetting the aging value when the object instance is referenced by an executing process.

As set forth in the Findings of Fact section above, Menon discloses selecting target segments for garbage collection only if their age exceeds an age threshold value. (FF 1.) In particular, Menon discloses that the age of a segment is determined when a time processor destage clock (132) generates a timestamp value for a segment when that segment is filled in the memory segment buffer (128) and written into the DASD array (106). (FF 2.) Further, Menon discloses that when a segment is filled by live tracks taken

from a GC-filled segment, the timestamp associated with the segment is set to the largest timestamp of any segment that contributed to a track during the garbage collection. (*Id.*) The age of a segment is determined by accounting for the difference between the current value of the destage clock and the timestamp of the segment itself. (*Id.*)

We find that Menon's disclosure of a time processor destage clock teaches a counter that utilizes a timestamp value, in conjunction with a threshold value, to generate the age of data segments. In particular, we find that Menon's disclosure teaches that when a data segment is referenced, the respective data segment is allotted the largest timestamp by the counter. Therefore, during garbage collection, the current value of the counter is compared to the timestamp of the data segment to determine whether the data segment exceeds the threshold value. However, the cited disclosure falls short of teaching or suggesting resetting the time stamp value when the object instance is referenced by an executing process. As noted in the Brief Summary of the Invention section above, when an object instance disposed in memory is referenced by an active process, the aging value associated with an object instance is reset before the process ends. Absent a showing that Menon expressly or inherently describes that when a data segment is referenced, the counter resets the time stamp value of the respective data segment, we find that the Examiner improperly relied on Menon's disclosure to teach the disputed limitation. Since Appellants have shown at least one error in the rejection of claims 6 and 13, we need not reach the merits of Appellants' other arguments. Therefore, it follows that Appellants have shown that the Examiner erred in finding that Menon anticipates independent claims 6 and 13.

Claims 8 and 15

Because claims 8 and 15 also incorporate the limitation discussed above, we find that Appellants have also shown error in the Examiner's rejection of these claims for the reasons set forth in our discussion of independent claims 6 and 13.

35 U.S.C. § 103(a)

Claim 1

Independent claim 1 recites, in relevant part, a listing of exempt classes based upon which object instances are exempted from being labeled loiterers.

As set forth in the Findings of Fact section above, Ozawa discloses executing a garbage collection process for collecting free memory areas of the memory resources. (FF 3.) In particular, Ozawa discloses that cells or objects are marked in three colors: white, black, and off-white. (FF 4.) Further, Ozawa discloses that white-marked objects are garbage and black-marked objects are not garbage. (*Id.*) We find that Ozawa's disclosure of black-marked objects teaches a data class that is exempt from being labeled as garbage. Although Ozawa does not disclose a plurality of data classes exempt from being labeled as garbage, the mere duplication of a data class exempt from being labeled as garbage has no patentable significance unless a new and unexpected result is produced. *See In re Harza*, 274 F.2d 669 (CCPA 1960); *see also* MPEP § 2144.04. Further, "if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *See KRS*, 550 U.S. at 417. In this case, we find that an ordinarily skilled

artisan would recognize that a single data class exempt from being labeled as garbage would predictably allow a plurality of such data classes as being similarly exempt from being labeled as garbage. Therefore, we are not persuaded by Appellants' argument that Ozawa's disclosure of black-marked cells only teaches a single class exempted from being labeled as a loiterer. (App. Br. 8-9; Reply Br. 8.) It follows that Appellants have not shown that the Examiner erred in concluding that the combination of Menon and Ozawa renders independent claim 1 unpatentable.

Claims 2 through 4, 10, and 12

Appellants do not provide separate arguments with respect to claims 2 through 4, 10, and 12. Therefore, we select claim 1 as being representative of the cited claims. Consequently, claims 2 through 4, 10, and 12 stand or fall with representative claim 1. 37 C.F.R. § 41.37(c)(1)(vii).

Claims 7, 9, 14, and 16

Dependent claims 7 and 9 recite the limitations of independent claim 6 and dependent claims 14 and 16 recite the limitations of independent 13. Therefore, Appellants submit that the combination of Menon and Ozawa does not render dependent claims 9 and 16 unpatentable and the combination of Menon, Ozawa, and Chrakraborty does not render dependent claims 7 and 14 unpatentable. (App. Br. 6-7; 9-10.) We agree with Appellants that neither Ozawa nor Chrakraborty remedy the deficiencies of Menon, as discussed above. Therefore, it follows that Appellants have shown that the Examiner erred in concluding that the combination of Menon and Ozawa renders dependent claims 9 and 16 unpatentable and the combination of Menon, Ozawa, and Chrakraborty renders dependent claims 7 and 14 unpatentable.

VI. CONCLUSIONS OF LAW

1. Appellants have shown that the Examiner erred in finding that Menon anticipates claims 6, 8, 13 and 15 under 35 U.S.C. § 102(b).
2. Appellants have shown that the Examiner erred in concluding that:
 - (a) the combination of Menon and Ozawa renders claims 9 and 16 unpatentable under 35 U.S.C. § 103(a).
 - (b) the combination of Menon and Chakraborty renders claims 7 and 14 unpatentable under 35 U.S.C. § 103(a).
3. Appellants have not shown that the Examiner erred in concluding that the combination of Menon and Ozawa renders claims 1 through 4, 10, and 12 unpatentable under 35 U.S.C. § 103(a).

VII. DECISIONS

1. We reverse the Examiner's decision to reject claims 6, 8, 13, and 15 under 35 U.S.C. § 102(b).
2. We reverse the Examiner's decision to reject claims 7, 9, 14, and 16 under 35 U.S.C. § 103(a).
3. We affirm the Examiner's decision to reject claims 1 through 4, 10, and 12 under 35 U.S.C. § 103(a).

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART

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